

***Interim Report
Site Investigation For Groundwater Contamination
At Fort Totten***

**Contract No. DACA51-93-D-0025
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Prepared for

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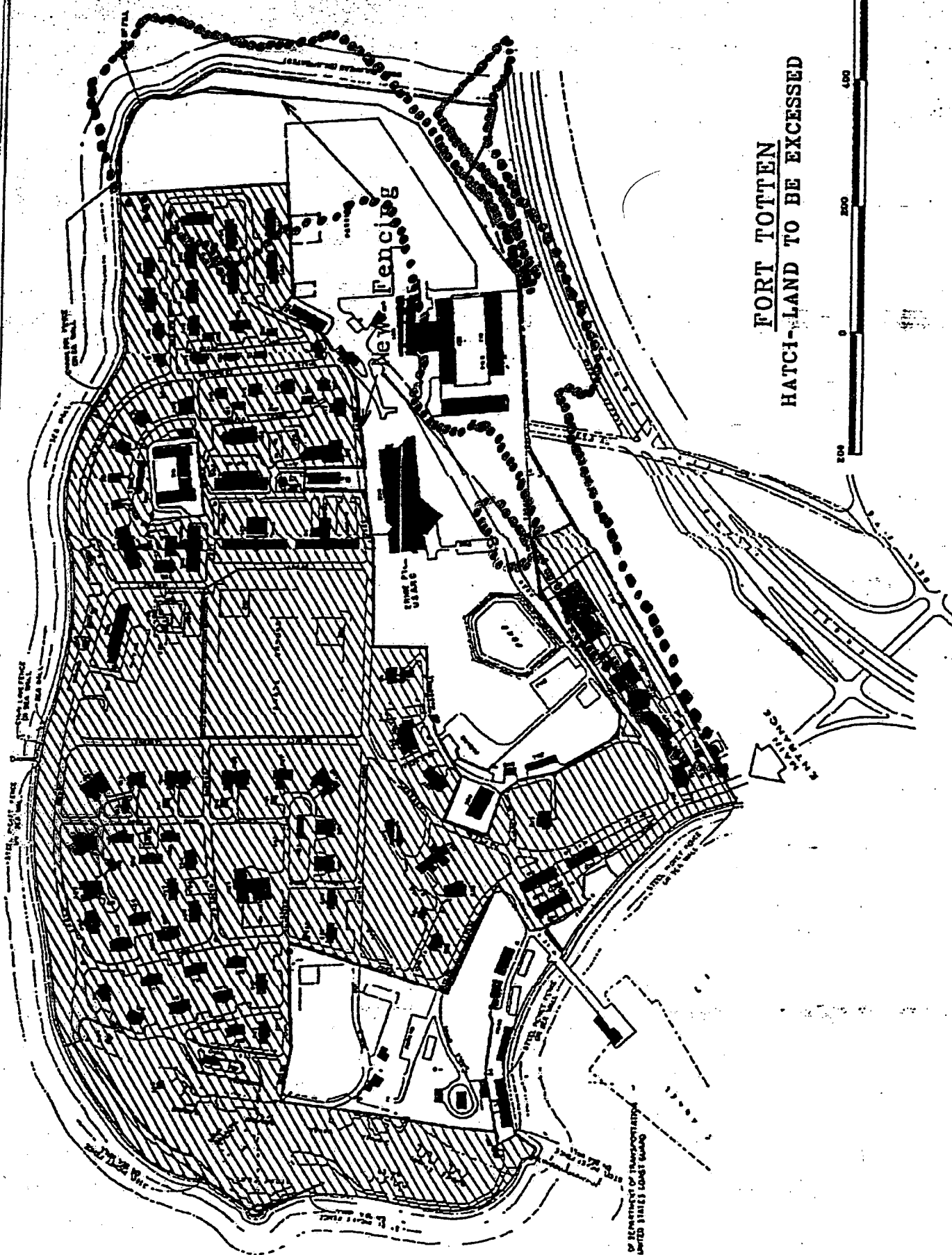
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Final Report

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FORT TOTTEN
HATCH-LAND TO BE EXCESSED



U.S. DEPARTMENT OF TRANSPORTATION
UNITED STATES GOVERNMENT

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1.0 EXECUTIVE SUMMARY

Eleven (11) new groundwater monitoring wells designated from P1 through P12 were installed at the landfill. One well (P2) was not installed because groundwater was not found in the borehole when auger reached a clay layer at 30 ft. depth. The wells were installed in accordance with 6 NYCRR Part 360.

Groundwater samples were taken from each well and analyzed for Target Compound List (TCL) organics, Target Analyte List (TAL) inorganics, and for selected list of the 6 NYCRR Part 360 Leaching Indicators. The assessment of analytical data was based on the NYS DEC Water Quality Standards for Ground Waters hereinafter referred to as Groundwater Standards.

Three organic contaminants: methylene chloride, xylenes, and bis(2-ethylhexyl)phthalate were detected in concentrations below method detection limits (MDLs). Only one volatile organic compound (1,1,2,2, tetrachloroethane) was detected in one sample (P1) in concentration slightly above MDL. None of TCL pesticides/PCBs was detected in the groundwater samples.

Analysis of groundwater samples, taken from wells P5 and P6, installed in the vicinity of the well MW-8 where high concentration of naphthalene was found in previous tests, indicate that this contamination is equal (P5), or below (P6) the NYSDEC Groundwater Standard for naphthalene.

Groundwater samples were tested on 23 metals. Metals that were detected in some samples in concentrations above the Groundwater Standards are: zinc (in samples P1, P12), manganese (in samples P1, P9, P11), lead (in samples P1, P5, P6, P10) Cadmium (in samples P1 and P7) and Iron in all samples except P12. These metals are commonly found in sewage.

The 6 NYCRR Part 360-2 Leachate indicators found in the groundwater are comparable to sewage-like contaminants. This suggests that a source of sewage contaminants exists at the site. The high level of ammonia, nitrates, Chemical Oxygen Demand (COD), and Total Organic Carbon (TOC) found in the groundwater in the study area, as well as the presence of landfill gas, may warrant further investigation.

The water level gauging data, obtained on March 31, 1995, from the eleven new monitoring wells indicates that there is a groundwater high centered in the vicinity of well P-11. Furthermore, the data indicates that the groundwater flow moves radially away from the high, in some cases this being towards the adjacent waterways. There appears to be slight tidal effect of 0.02 to 0.15 foot on six monitoring wells installed near the shoreline. This tidal effect would not cause any change in direction of groundwater.

The conclusions and recommendations of this study agree with the major conclusions and recommendations of the previous study carried out in 1989 with the following exceptions:

- The level of naphthalene in the vicinity of well MW8 is negligible.
- We cannot conclude, without further testing, that the leachate has a detrimental impact on the environment of Little Neck Bay.
- There is evidence that soil gas, assumed to be methane, is being generated by the landfill. This was detected in a previous study in 1986 which stated, "The data generated from the analysis of the soil gas showed that methane generation posed no explosion hazard. Data from the five wells produced a range in values from nondetectable up to 5.0 parts per million (ppm). The detection limit for methane with the instrument used is 1.0 ppm. the lower explosive limit for methane is 53,000 ppm. Therefore the possibility of an explosion is remote at best."

Before proceeding further we recommend:

Meeting with the NYSDEC to review results of this program and determine if more sampling is required.

Additional site investigations (if required) could include :

- Soil sampling and analysis to evaluate the extent of groundwater contamination with sewage-like contaminants.
- Collection and analysis of two additional groundwater samples (during dry and wet periods) to determine whether seasonal fluctuations occur in contaminant concentrations in the groundwater.

2.0 INTRODUCTION

Landfilling at Fort Totten began in the late 1930 at a 10-acre salt marsh area on the southeastern corner of the Fort adjacent to Little Neck Bay. Landfill operation were discontinued in 1958 when enlisted housing was constructed on a portion of the site. Figure 2 shows the approximate location of the landfill's western boundary, location of buildings and paved areas.

Previous Phase 1, 2, and 3 Geologic Studies conducted by the US Army Environmental Hygiene Agency (USAEHA) in September 1986, August 1987 and April 1989, respectively, included installation of groundwater monitoring wells and analysis of groundwater samples.

Conclusions of the Phase 3 Report included:

- 1) Results of groundwater analyses showed 0.8 mg/l of naphthalene in well MW-8 and presence of ammonia, iron and manganese in some wells in elevated concentrations indicating that the landfill was producing leachate which migrated into groundwater.
- 2) It was concluded that the leachate which was migrating off-site may have significant detrimental impact on the environment of Little Neck Bay.
- 3) The leachate does not pose a direct health hazard to the public, but it may have a significant detrimental affect on the environment of Little Neck Bay.

Recommendations of Phase 3 Report included:

- 1) The possible leakage of the Fort Totten sewage system should be investigated.
- 2) The landfill should be closed in accordance with 6NYCRR Part 360.

Malcolm Pirnie, Inc. conducted in July, 1993 a records search for the Fort Totten Landfill. The federal database search indicated that Fort Totten is a registered RCRA facility generating at least 2,200 pounds per month of non-acutely hazardous wastes or 2.2 pounds per month of acutely hazardous wastes. Fort Totten was not found in any of the State databases searched. No Sanborn Maps were found for this site.

3.0 SITE INVESTIGATION

3.1 General

Prior to commencing the design of the final landfill Closure Plan, a site investigation was developed to obtain supplementary information needed to accomplish the proposed landfill closure in accordance with 6 NYCRR Part 360. The site investigation activities included two tasks:

- Task 1. Site investigation for groundwater contamination.
- Task 2. Site investigation to determine tidal influence on groundwater table. This task includes determination of groundwater flows.

The following Tasks 1 and 2 site investigation services have been conducted:

- 1. Installation of eleven (11) monitoring wells;
- 2. Collection and analysis of groundwater samples;
- 3. Survey of monitoring wells;
- 4. Tidal influence on groundwater elevation, and,
- 5. Assessment of results.

3.2 Installation of Monitoring Wells

Eleven (11) new monitoring wells designated from P1 through P12 were installed at the locations shown on Figure 1, Site Plan. (Well No. P2 was not installed because groundwater was not found in the borehole when the auger reached a clay layer at 30 ft. depth). The wells were installed in accordance with 6 NYCRR Part 360 and NYS DEC Guidance for Exploratory Borings, Monitoring Well Installation, and Documentation of these Activities. All wells were installed in the Upper Water Bearing Zone at depths varying from 20 to 30 feet below ground surface. After installation wells were developed as per NYS DEC protocol. Drilling and well installation was performed by Aquifer Drilling and Testing, Inc., New York.

Well installation procedures are included in Appendix C. Summary of well installation data and well construction sketches are included in Appendix A.

3.3 Survey of Monitoring Wells

Chas. H. Sells, Inc., a New York State licensed surveyor, established elevation (vertical control) and location (horizontal control) of each installed well on February 8, 1995. The survey point was the highest point of PVC pipe (riser).

3.4 Groundwater Sampling and Analysis

Groundwater sampling was performed in accordance with 6 NYCRR Part 360, EPA SW-846, and NYS DEC Sampling Guidelines & Protocols, March 1991. Groundwater summary report is included in Appendix B. Groundwater sampling procedures are described in Appendix C.

Groundwater samples were analyzed for Target Compound List (TCL) organics, Target Analyte List (TAL) inorganics and for selected 6 NYCRR Part 703 Leachate Indicators (ammonia, nitrate, total nitrogen, COD, chloride and TOC).

All samples were tested by Accredited Laboratory, Inc. of Carteret, New Jersey. This laboratory is a New York State Department of Health Certified laboratory (NYS Certification No. 11109).

The laboratory submitted Analytical Data Reports on January 11, 1995. A copy of selected pages, including the Chain-of-Custody form, and methodology summary are presented in Appendix D.

3.5 Tidal Influence on Groundwater Elevation

Groundwater elevation of each monitoring well was measured on March 1, 1995 in the morning and in the afternoon. Measurements, presented in Table 6, indicated that six of eleven monitoring wells showed slight change in water elevation (from 0.02 to 0.15 foot) due to tide.

4.0 FINDINGS

4.1 Site Hydrogeologic Conditions

Fort Totten is located in northeast Queens County, Long Island, New York, where unconsolidated deposits of sand, gravel, silt, clay, with a cumulative thickness of 250 feet to 300 feet, overlie the surface of crystalline bedrock at an elevation 250 feet below Mean Sea Level. At Fort Totten, two major aquifers have been reported: 1) The Lloyd Sand, of Cretaceous age, at a depth of 200 feet, and 2) glacial deposits of Upper Pleistocene age, in the depth range of 50 feet to 150 feet below ground surface. The Upper Water Bearing Zone (UWBZ), consisting of fill, Recent unconsolidated sands, and associated marsh deposits, which is found from the ground surface to depths of 20 feet to 30 feet, is not used as a source of potable water supply. The soil and groundwater contamination encountered at Fort Totten in the current investigation has been discovered in the UWBZ.

The results of the pre-design investigation at the Fort Totten landfill showed the following:

- 4.1.1 The new monitoring wells, screened in the UWBZ, consisted of unconsolidated sandy fill, refuse, recent natural sand, overlying soft, dark gray silty clay of low permeability - Tidal Marsh Deposit (TMD). The unconsolidated deposits of glacial origin which underlie the TMD, do not appear to have been penetrated by any of the eleven new monitoring wells.
- 4.1.2 Groundwater in the UWBZ is unconfined. Groundwater gauging data collected on March 1, 1995 (Table 6) suggests that a groundwater high is centered in the vicinity of P11, with groundwater flow moving radially away at an average hydraulic gradient of 0.009 ft/ft.
- 4.1.3 There appears to be a slight tidal effect of 0.02 to 0.15 foot in six wells near the shoreline (P1, P4, P8, P9, P10, and P12). This tidal effect would not cause any significant change in direction of groundwater flow.

4.2 Chemical Analysis

4.2.1 Basis for Chemical Analysis

The assessment of chemical analysis was made to evaluate existence and magnitude of contamination problems. It was based on comparison of results of groundwater analyses with NYSDEC Cleanup Policy and Guidance, Groundwater Quality Standard for Class GA (Drinking Water Source), October 1991, hereinafter referred to as Groundwater Standard. It should be noted that the Class GA cannot be correctly applied in this study as described below:

The correlation of water elevation in wells with tidal cycles indicates that water levels in wells P1, P4, P8, P9, and P12, slightly fluctuate due to the pressure wave that is

transmitted through the underlying aquifer by tidal loading on the adjacent surface water body (Little Neck Bay). Other than physical impacts, the Upper Water Bearing Zone is probably chemically affected at well locations near the shoreline due to the effects of saltwater intrusion. Therefore, NYS DEC class "GA" Groundwater Standard cannot be applied for comparison at these locations. The NYS DEC class "SA" and "SB" Saline Surface Water Quality Standards and Guidelines appears to be the most applicable values for comparison where salt water intrusion has occurred. Direct comparison between chemical concentrations and "SA" and "SB" Standards cannot be also made due to fact that they are not groundwater standards.

4.2.2 Results and Assessment of Results

Organic Compounds

Methylene chloride was found in concentrations below the Groundwater Standard (5 ug/l) in groundwater samples P3 (1 J ug/L), P4 (2 J ug/l), P5 (3 J ug/l), P11 (3 B ug/l), P12 (3 B ug/l) and P13, which is duplicate of P8 (2 B ug/l). This common laboratory contaminant was also detected in the trip blank, TB (results are flagged with B) suggesting that the contamination is caused by sample handling. **Chloroform** was found in one sample only (P1) in concentration of 4 ug/l which is below method detection limit, MDL (result is flagged with J), and the Groundwater Standard (100 ug/l). **Xylenes**, common laboratory contaminants, are found in one sample (P9) in concentrations below MDLs. Volatile organic compound **1,1,2,2 tetrachloroethane** was found in one sample (P1) in concentration of 8 ug/l which is above the Groundwater Standard (5 ug/l). This compound is a solvent used for paint removers, varnishes, and degreasers and was found in the sample taken near houses suggesting that the contaminant might have been introduced in the soil during or after construction of the houses.

Naphthalene was found in groundwater samples obtained from two of the monitoring wells installed for this investigation, P5 (10 J ug/l) and P6 (6 J ug/l). A comparison with the Groundwater Standard of 10 ug/l (guidance value) shows that naphthalene was found in concentration equal or below that value as well as below MDL (result is flagged with J). In previous groundwater analyses of samples taken from well MW-8, which is located between wells P5 and P6, naphthalene was detected in concentrations of 800 ug/l (in April, 1989), and 5,800 ug/l (in August 1987). Results of present analysis confirmed the presence of naphthalene in groundwater in that area but in significantly lower concentrations. **Bis(2-Ethylhexyl)Phthalate** is found in one sample (P4) in concentration below MDL. This is a common laboratory contaminant and most likely was introduced in the sample during sample handling.

Pesticides/PCBs were not detected in any of eleven groundwater samples.

Inorganic Compounds

Antimony, arsenic, beryllium, chromium, mercury, selenium, silver, and thallium were not

detected in any of eleven groundwater samples.

Several metals were found in groundwater samples for which there is no groundwater standard. They are: **aluminum** (found in four samples: P1, P6, P7, and P10), **cobalt** (found in one sample: P1), **nickel** (found in one sample: P1) and **calcium, potassium and sodium** (found in all samples). High concentrations of sodium and potassium are probably caused by the impacts of tidal waters on the Upper Water Bearing Zone. High concentration of aluminum in well P1 is most likely caused by contamination of the well with bentonite during well construction.

Barium and **manganese** were detected in eleven wells, **vanadium** in one well, and **cadmium** in four wells. With exception of concentration of manganese found in well P1, all concentrations were below or slightly above the Groundwater Standards. Well P1 contained manganese in concentration (5560 ug/l) which exceeds by 18 times the Standard (300 ug/l).

Zinc was found in two samples (P1: 622 ug/l, and P12:1350 ug/l) in concentrations above the Standard (300 ug/l). Though zinc is commonly found in groundwaters, the deterioration of galvanized iron can substantially elevate level of zinc in the waters. High zinc concentrations also may result from industrial waste pollution.

In comparison with the Standard of 25 ug/l, **lead** was found in P1, P5, P6, and P10 samples in concentrations of 553, 35, 30.7, and 193 ug/l, respectively. Natural waters generally contain very low levels of lead due to its tendency to be precipitated by a large number of substances. Lead in groundwater usually indicates contamination by industrial wastes, or decomposition of ammunition, plumbing fixtures and pipes.

Leachate Indicators

Nitrogen. In general, the presence of ammonia, nitrites, and nitrates indicate organic pollution. By definition, ammonia nitrogen is a product of degradation of organic compounds (animal and plant protein) containing nitrogen or natural reduction of nitrate under anaerobic conditions. If aerobic conditions are present, it can be expected that ammonia will be oxidized to nitrites and finally to nitrates. Presence of ammonia (16.1-145 mg/l) in the groundwater above the Groundwater Standards (2 mg/l) indicates organic pollution.

COD. The analysis of Chemical Oxygen Demand (COD) is used to evaluate the pollution strength in a quantitative way and to estimate the requirement of a given water for oxygen. Typical values for New York City domestic sewage influent to a sewage treatment plant ranges between 200 and 500 mg/l and effluent between 30 and 70 mg/l. COD concentrations for P1, P9 and P10 samples (95,102 and 111 mg/l, respectively), found to be above sewage effluent concentration range, indicate organic pollution.

TOC. As the Total Organic Carbon (TOC) analysis is used to measure all carbon atoms covalently bonded in organic molecules it can be also used to evaluate organic pollution of groundwater. A comparison of analytical results of groundwater tests with New York City

influent sewage (which typically contains 40 to 75 mg/l of TOC) shows that P3, P8 and P10 samples, containing 45, 97 and 75 mg/l, respectively, may be contaminated by sewage.

TOX. The presence of halogenated organic molecules, expressed as Total Organic Halogen (TOX), is indicative of synthetic organic contamination. TOX result include trichloromethenes, organic solvents and other halogenated alkanes and alkenes, chlorinated and brominated pesticides and herbicides, and chlorinated aromatics. There are no standards for TOX. The concentrations of TOX found in samples are 3 to 8 times MDL. Since this parameter does not represent concentration of an individual hazardous substance but the total concentration of all halogenated organics, it cannot be considered as a quantitative evidence that an "observed release" exists.

Chlorides. Chloride was found in concentrations from 15 to 1280 mg/l indicating that some wells (P5, P9, P10, and P11) are more affected by salt water intrusion than others at the time of water sampling.

Odor and landfill gas. During the sampling and water level measurements, strong odor and gas (most likely landfill gas containing methane) emanating from monitoring wells was observed. It also indicates presence of biological wastes which under anaerobic conditions produces a gas, generally containing about 50 to 55% of methane and 40 to 45% of carbon dioxide. The strongest odor was observed at well P-8.

5.0 CONCLUSIONS

Based on groundwater analysis performed during this investigation as well as on analysis performed during previous studies, the following conclusions can be made:

- 5.1 With exception of 1,1,2,2 tetrachloroethane, no volatile organics, semivolatile organics nor pesticides/PCBs were detected in the groundwater samples in concentrations above MDLS.
- 5.2 Phase 3 results indicated high concentrations (800 ug/l) of naphthalene, and traces of a few semivolatiles in well MW-8. Recent tests on wells P5 and P6, located near MW-8, showed low levels (10 and 6 ug/l, respectively) of naphthalene, and no other semivolatile organic compounds.
- 5.3 Previous studies and the recent investigations indicate the presence of sewage type contaminants at the site. This suggests that there could be leakage from the Fort Totten sewer system. Our review of the sanitary sewer survey indicates that, in general, the sewer lines upgradient from the landfill were in good condition when the survey was made which was at about the same time as the earlier studies were carried out.
- 5.4 Groundwater samples were tested on 23 metals. Only zinc, manganese, iron, cadmium and lead were detected in some samples in concentrations above the groundwater standard. These metals are commonly found in landfill leachate.
- 5.5 It appears that there is slight tidal effect on groundwater elevation of six wells installed near the shoreline, and no observed effect on groundwater direction.
- 5.6 Generally, groundwater is moving radially from the groundwater high at P-11 at an average hydraulic gradient of 0.009 ft/ft.

6.0 RECOMMENDATIONS

Before proceeding further we recommend:

- Meeting with the NYSDEC to review results of this program and determine if more site investigations are required and the requirements for closure.

The additional site investigations could include:

- Collection of second and third rounds of samples from all eleven wells and analysis of samples for naphthalene, leaching indicators and metals (zinc, manganese and lead, only).
- Conducting water level measurements to determine if seasonal fluctuations occur in contaminant concentrations in the groundwater and provide further information on the hydraulic characteristics of the groundwater.

The collection of groundwater samples and water level measurements should be performed during dry second round and rainy third round periods. The time of third round sampling should be scheduled following a significant rainfall event to observe infiltration effect on groundwater quality.

- A more detailed soil sampling plan to evaluate cause of groundwater contamination and further delineate contamination.

TABLES

Table 1 - Analysis Performed

Parameter \ Well No	1	3	4	5	6	7	8	9	10	11	12	D
TCL Volatiles	X	X	X	X	X	X	X	X	X	X	X	X
TCL semivolatiles	X	X	X	X	X	X	X	X	X	X	X	X
TCL Pest.\PCBs	X	X	X	X	X	X	X	X	X	X	X	X
TAL Metals+Cyanide	X	X	X	X	X	X	X	X	X	X	X	X
COD	X	X	X	X	X	X	X	X	X	X	X	X
Ammonia	X	X	X	X	X	X	X	X	X	X	X	X
Chloride	X	X	X	X	X	X	X	X	X	X	X	X
Sulfate, Nitrate, TKN		X					X		X			X
TOC, TOX, TDS		X					X		X			X

Notes:

X indicates that analysis was performed
 Pest Pesticides
 TKN Kjeldah (total) nitrogen
 COD Chemical Oxygen Demand
 TOC Total Organic Carbon
 TDS Total Dissolved Solids
 TOX Total Organic Halogens

Table 2 - Organic Analysis Data

(All data in ug/l)

Organics/ Sample No.	Methylene- chloride	Chloroform	1,1,2,2Tetra chloroethane	Xylenes	Naphthalene
P1	ND	4 J	8	ND	ND
P3	1 J	ND	ND	ND	ND
P4	2 J	ND	ND	ND	ND
P5	3 B	ND	ND	ND	10 J
P6	ND	ND	ND	ND	6 J
P7	ND	ND	ND	ND	ND
P8 DUP (1)	ND	ND	ND	ND	ND
P8 DUP	2 B	ND	ND	ND	ND
P9	ND	ND	ND	6 J (3)	ND
P10	ND	ND	ND	ND	ND
P11	3 B	ND	ND	ND	ND
P12	3 B	ND	ND	ND	ND
TB	4 B	ND	ND	ND	ND
Standard	5	10	5	5	10 (2)

Notes:

1. All samples were analyzed for TCL volatile and semivolatile organic compounds and TCL pesticides and PCBs. Only three compounds were detected as shown in Table 1.
- ND Not detected
- 1 Duplicate analysis of P8 sample. It was designated as P13.
- 2 NYSDEC Groundwater cleanup guidance value
- 3 Sample P9 contained: m,p-xylenes (4 J ug/l), o-xylene (2 J ug/l), and ethylbenzene (4 J ug/l)
- B Indicates compound found in associated blank
- J Indicates compound concentration found below method detection limit (MDL)

Table 3 - Inorganic Analysis Data
(All data in ug/l)

Analyte	P1	P3	P4	P5	P6	P7
Aluminum	12100	ND	ND	ND	272	41
Antimony	ND	ND	ND	ND	ND	ND
Arsenic	ND	ND	ND	ND	ND	ND
Barium	709	462	289	807	553	721
Beryllium	ND	ND	ND	ND	ND	ND
Cadmium	17.5	ND	ND	ND	10.7	25.5
Calcium	188000	89900	136000	46200	100000	71400
Chromium	ND	ND	ND	ND	ND	ND
Cobalt	82.2	ND	ND	ND	ND	ND
Copper	144	ND	ND	ND	ND	ND
Iron	18800	44200	33900	20600	31600	20300
Lead	553	ND	ND	35	30.7	15.4
Magnesium	32800	10600	15200	27900	30400	17000
Manganese	5560	242	262	73.2	164	279
Mercury	ND	ND	ND	ND	ND	ND
Nickel	89.9	ND	ND	ND	ND	ND
Potassium	7210	13700	17600	34200	43400	20600
Selenium	ND	ND	ND	ND	ND	ND
Silver	ND	ND	ND	ND	ND	ND
Sodium	109000	37700	53500	1650000	582000	33100
Thallium	ND	ND	ND	ND	ND	ND
Vanadium	81.3	ND	ND	ND	ND	ND
Zinc	622	ND	ND	ND	102	ND

Note:

ND - Compound analyzed for but not detected

Table 3 - Inorganic Analysis Data (Cont'd)
(All data in ug/l)

Analyte	P8	P8 DUP*	P9	P10	P11	P12	Standard
Aluminum	ND	ND	ND	1030	ND	ND	NA
Antimony	ND	ND	ND	ND	ND	ND	NA
Arsenic	ND	ND	ND	ND	ND	ND	25
Barium	441	446	296	672	69.5	ND	1000
Beryllium	ND	ND	ND	ND	ND	ND	NA
Cadmium	ND	10.2	ND	10.6	ND	ND	10
Calcium	102000	102000	94200	113000	55800	29200	NA
Chromium	ND	ND	ND	ND	ND	ND	50
Cobalt	ND	ND	ND	ND	ND	ND	NA
Copper	ND	ND	ND	ND	ND	ND	1000
Iron	31100	31900	16000	43400	3140	ND	500
Lead	ND	ND	ND	193	ND	ND	25
Magnesium	23200	23000	69600	33400	41400	4080	35000
Manganese	186	189	516	277	582	ND	300
Mercury	ND	ND	ND	ND	ND	ND	2
Nickel	ND	ND	ND	ND	ND	ND	NA
Potassium	26700	26100	47800	32700	13200	17700	NA
Selenium	ND	ND	ND	ND	ND	ND	10
Silver	ND	ND	ND	ND	ND	ND	50
Sodium	86000	87200	875000	95300	119000	49300	NA
Thallium	ND	ND	ND	ND	ND	ND	ND
Vanadium	ND	ND	ND	ND	ND	ND	NA
Zinc	ND	ND	ND	223	ND	1350	300

Note:

* Field duplicate analysis of sample P8 designated as P13

Standard NYSDEC Groundwater Cleanup Standard

Table 4 - Leachate Indicators Analysis Data
(TOX in ug/l, all other data in mg/l)

Analytes	P1	P3	P4	P5	P6	P7
Chloride	254	27.9	15.0	140	32.2	49.4
Cyanide,total	ND	ND	ND	ND	ND	ND
COD	95	25	12	187	70	27
Nitrogen,Ammonia	1.14	16.1	24.9	70.9	66.7	38.5
Nitrogen, nitrate		0.49				
Nitrogen,total		32.6				
Sulfate		ND				
TDS		689				
TOC		45				
TOX		ND				

Table 4 - Leachate Indicators Analysis Data (Cont'd)
(TOX in ug/l, all other data in mg/l)

Analytes	P8	P8 DUP*	P9	P10	P11	P12	Standard
Chloride	25.1	96.7	1280	115	178	60.9	250
Cyanide, total	ND	ND	.021	ND	ND	ND	0.10
COD	26	35	102	111	7	6	NA
Nitrogen, Ammonia	92.8	66.8	27.5	145	0.32	0.1	NA
Nitrogen, nitrate	0.28	0.45		0.3			NA
Nitrogen, total	94.5	100		156			10
Sulfate	ND	ND		28.9			250
TDS	631	1300		1610			NA
TOC	97	45		75			NA
TOX	53	30		85			NA

Notes:

COD Chemical Oxygen Demand
 TOC Total Organic Carbon
 TDS Total Dissolved Solids
 TOX Total Organic Halogens
 Blank indicates that the analysis was not performed
 ND Compound analyzed for but not detected
 Standard NYSDEC Water Cleanup Criteria, NYS Ambient Water Quality Standards
 NA Not available
 * Field duplicate analysis of sample P8 designated as P13

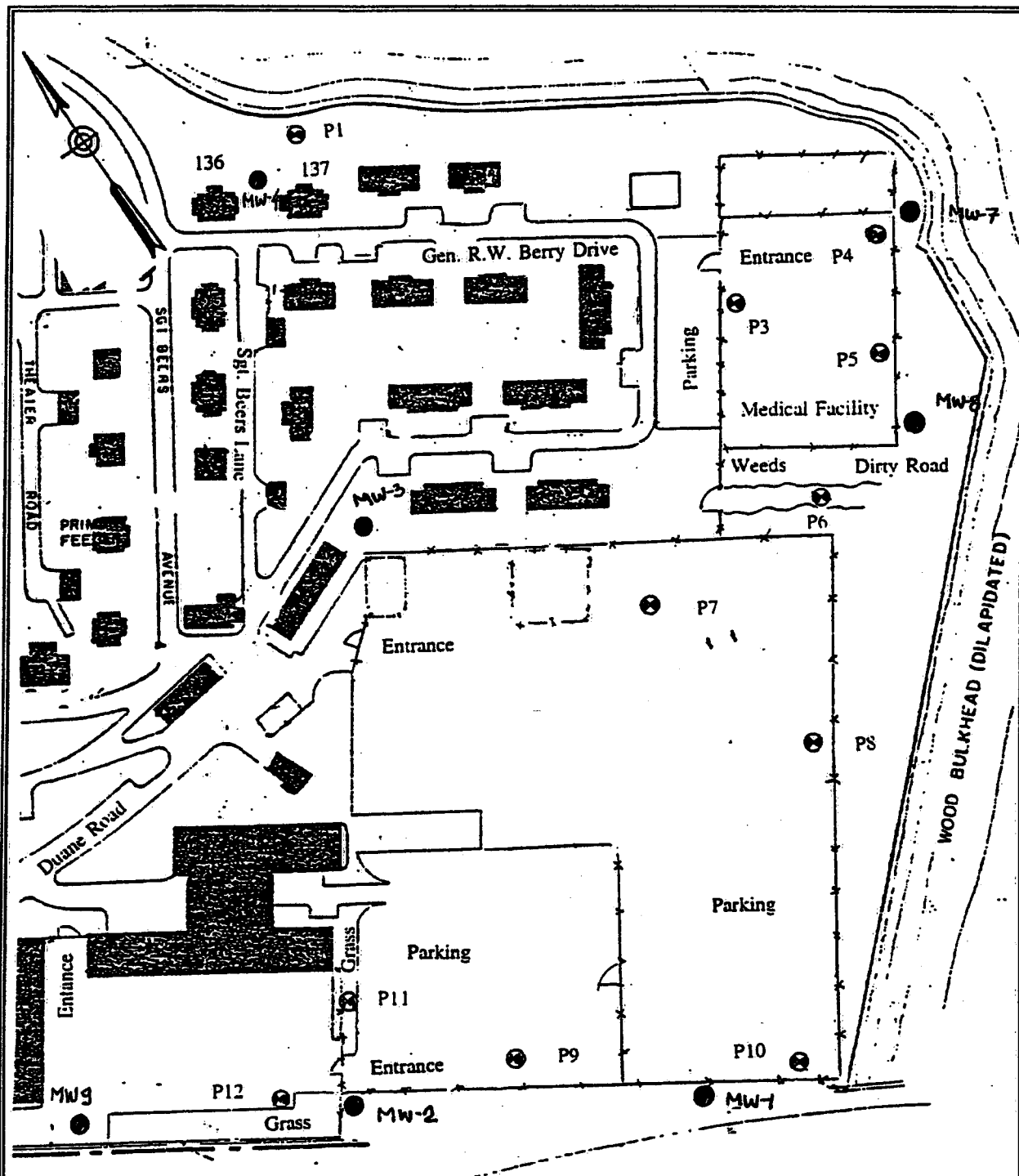
Table 5 - Groundwater Elevations
(Date: 1 March 1995)

Well No.	Time	Depth to Water, (feet)	Well Elevation, (feet)	Water Surface Elevation,(feet)
P1	10:55	16.90	19.14	2.24
P3	10:50	15.40	20.05	4.65
P4	10:40	20.30	23.97	3.67
P5	10:45	16.66	20.75	4.09
P6	12:30	6.10	11.25	5.15
P7	12:00	9.15	14.55	5.40
P8	11:05	8.80	13.74	4.94
P9	10:10	9.97	14.61	4.64
P10	11:50	8.70	13.41	4.71
P11	9:55	7.8	13.82	6.02
P12	10:25	3.7	8.85	5.15
P1	14:20	16.85	19.14	2.29
P3	13:50	15.40	20.05	4.65
P4	13:10	20.23	23.97	3.74
P5	14:00	16.66	20.75	4.09
P6	15:10	6.10	11.25	5.15
P7	14:50	9.15	14.55	5.40
P8	14:35	8.76	13.74	4.98
P9	13:35	9.97	14.61	4.66
P10	14:40	8.65	13.41	4.76
P11	13:30	7.80	13.82	6.02
P12	13:10	3.55	8.85	5.30

Table 6 - Groundwater Level Measurements
(Date: March 1, 1995)

Well No.	Water Elevation, ft (Time)	Water Elevation,ft (Time)	Water Elevation, Difference, ft
P1	2.24 (10:55)	2.29 (14:20)	0.04
P3	4.65 (10:50)	4.65 (13:50)	0.00
P4	3.67 (10:40)	3.74 (13:55)	0.07
P5	4.09 (10:45)	4.09 (14:00)	0.00
P6	5.15 (12:30)	5.15 (15:10)	0.00
P7	5.40 (12:00)	5.40 (14:50)	0.00
P8	4.94 (11:05)	4.98 (14:35)	0.04
P9	4.64 (10:10)	4.66 (13:35)	0.02
P10	4.64 (11:50)	4.76 (14:40)	0.05
P11	6.02 (9:55)	6.02 (13:30)	0.00
P12	5.15 (10:25)	5.30 (13:10)	0.15

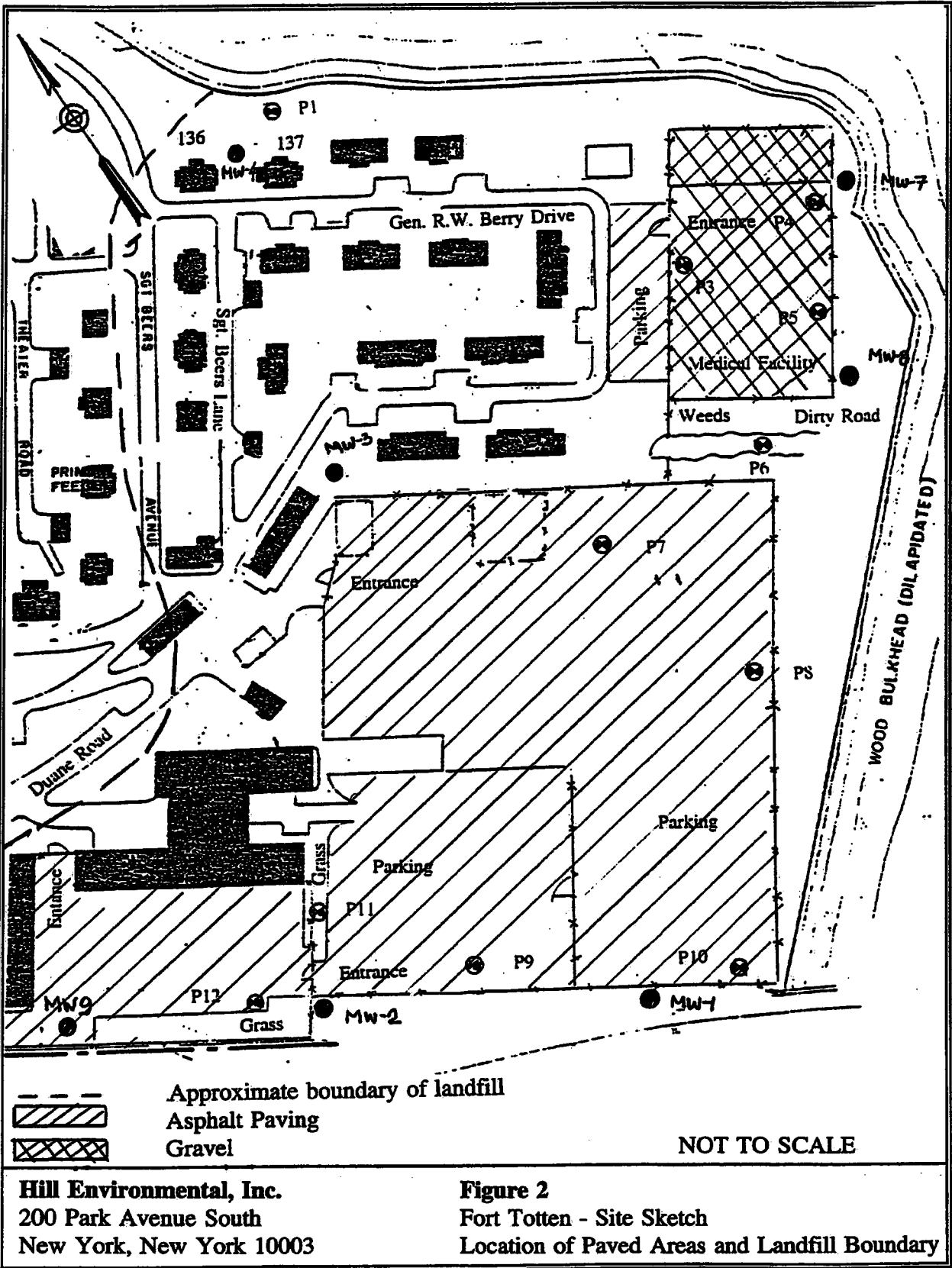
FIGURES



P Indicates location of wells installed for this study in 1994
 MW Indicates location of wells installed for previous study

Hill Environmental, Inc.
 200 Park Avenue South
 New York, New York 10003

Figure 1
 Fort Totten - Site Sketch
 Locations of Monitoring Wells



APPENDIX A
FIELD WORK REPORT

INSTALLATION OF WELLS

WELL INSTALLATION SUMMARY REPORT

Site Name: Fort Totten
Date: 11/14 - 11/22/94
Site Personnel: A. Kostic, L. Page (part time), T. McManus (part time)
Driller: Aquifer Drilling and Testing, Co.

Eleven overburden monitoring wells were installed by drilling with 6.25-inch I.D. hollow-stem augers. The monitoring wells were designated from P1 through P12. Well No. P2 was not installed because there was no water in the borehole when auger reached a clay layer at 30 feet. A 4-inch Dia. PVC Sch. 40 slotted well screen (No. 20) was installed at the bottom of each well. The length of the screen was from 10 to 15 feet. The screen was connected to the surface with a 4-inch, flush joint, Sch. 40 PVC riser. A No. 2 sand pack was placed around screen and approximately two feet above the screen. A 6-inch fine sand pack and approximately 2-foot bentonite seal was placed on the top of the sand pack. The remaining annular space was filled with cement/bentonite grout. A steel protective casing was set over each well and secured into the ground with concrete.

Split spoon samples were collected at 5-foot intervals for the purpose of soil characterization. Hnu reading of each sample were recorded. No reading above the background level was recorded. During the drilling activities, each borehole was frequently checked for presence of volatile organics and explosive gases with a Hnu meter and an explosimeter, respectively.

Each well was developed by pumping water to remove the maximum practical quantity of sediment and other fine materials from the screen sand pack in an attempt to develop wells yielding sediment-free water.

Schematic diagram of each well is enclosed in this Appendix.

Table 1 - Well Data

Well No.	Boring Depth, ft	Depth to Water, ft.(1)	Length of Screen, ft.	Type of Casing (2)
P1	20	NA	10	FM
P2	(3)			
P3	30	20	15	FM
P4	30	20	15	AG
P5	25	13	15	FM
P6	25	15	15	FM
P7	24	10	15	FM
P8	23	13	15	FM
P9	24	13	15	FM
P10	20	12.5	10	FM
P11	25	14	15	AG
P12	20	18	10	FM

Notes:

1. Depth to water from the ground surface at the time of well installation.
2. Casings are installed above ground (AG) or flush-mount (FM).
3. Well P2 was not installed because there was no water in the boring when auger reached a clay layer at 30 feet depth.

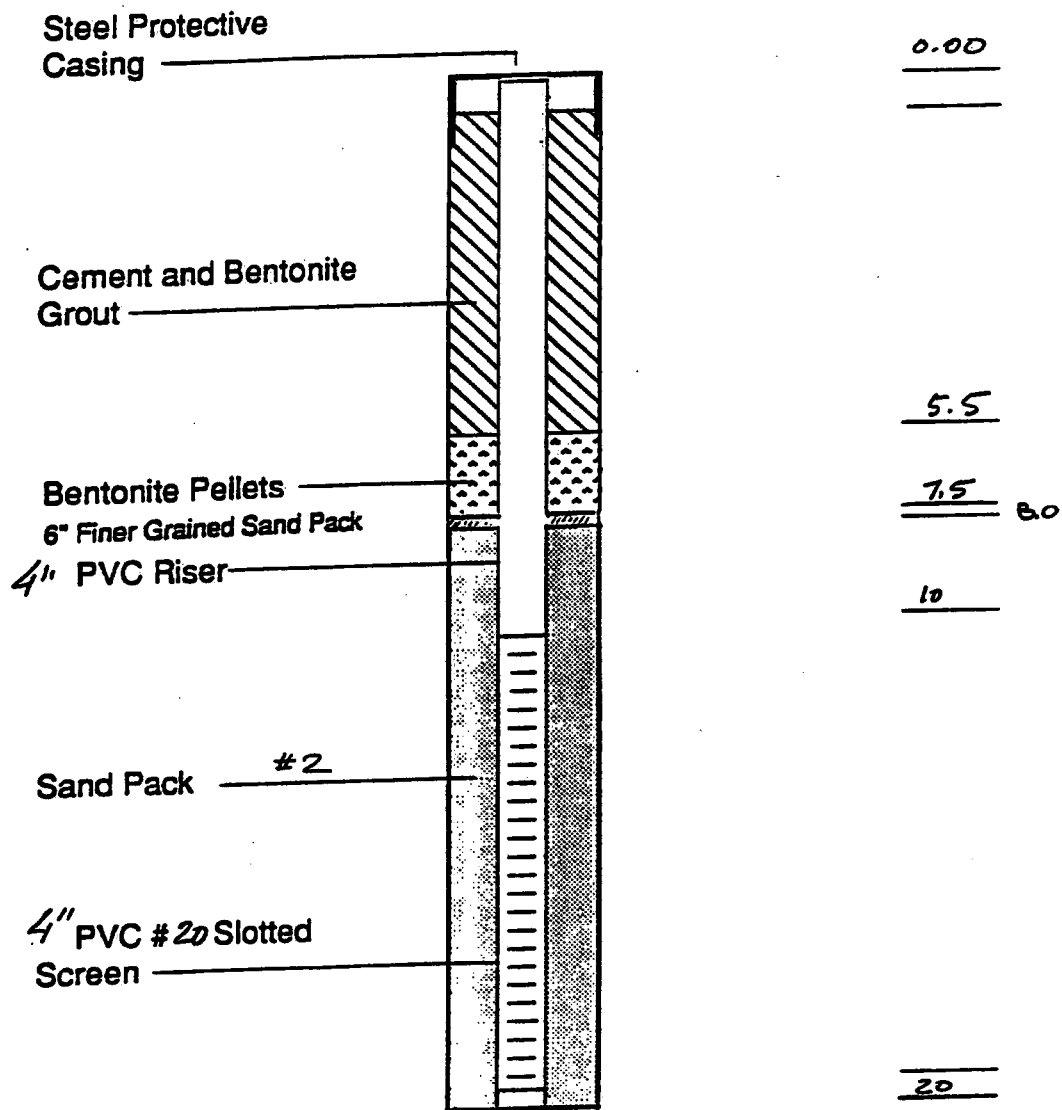
Site: FOOT TOTTER

Well No.: P1

Date Installed: 11-18-94

Elevations (ft)

FLUSH MOUNTED WELL



Water Level from Top of (Casing)(Riser):

Date: 11-17-94 Time: 10:00

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New York, N.Y. 10001

OVERBURDEN WELL CONSTRUCTION
SCHEMATIC

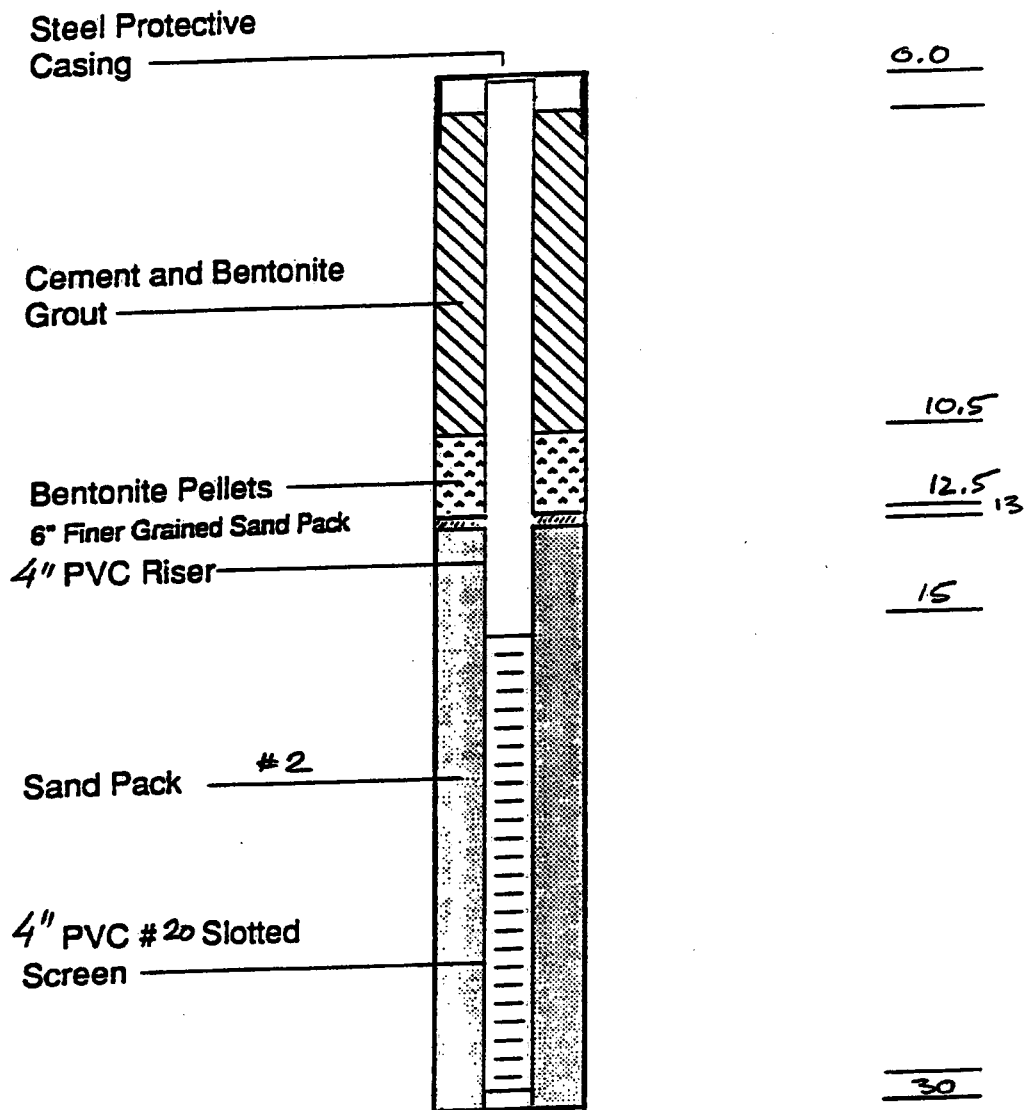
Site: FORT TOTTEN

Well No.: P3

Date Installed: 11-21-94

Elevations (ft)

FLUSH MOUNTED WELL



Water Level from Top of (Casing) (Riser): 20 ft Date: 11-21-94 Time: 9 30

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New York, N.Y. 10001

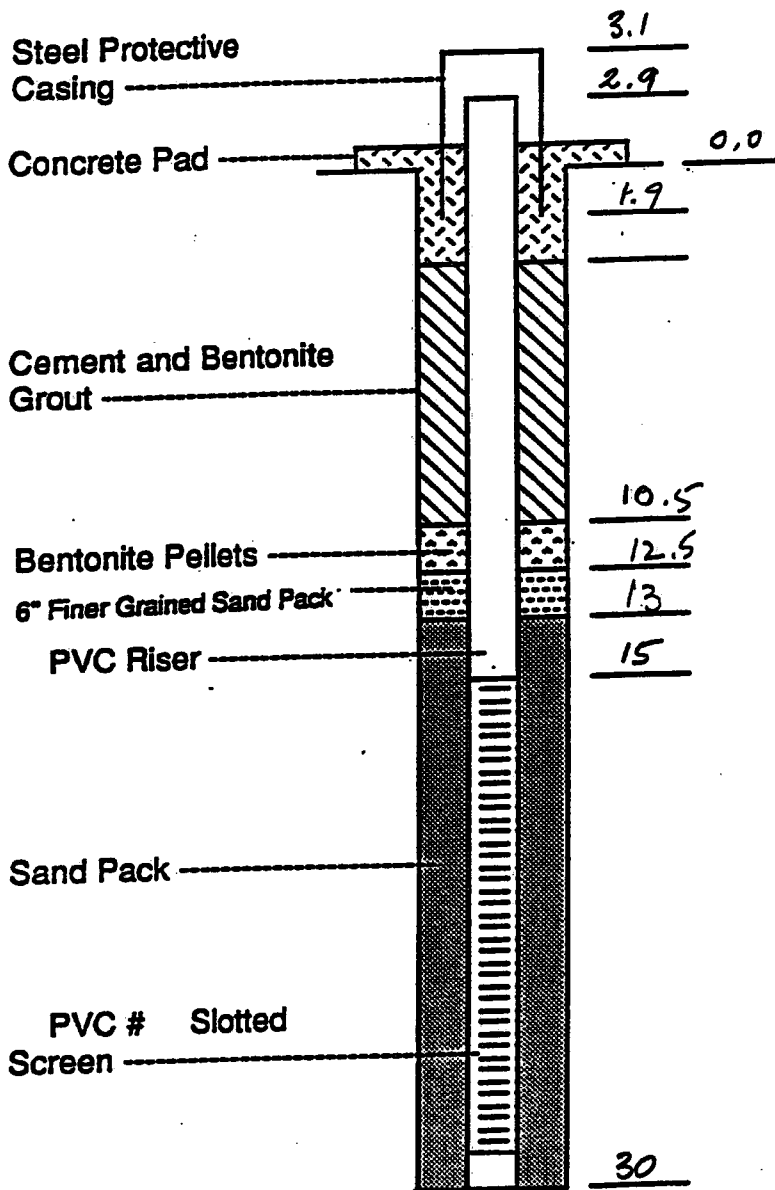
OVERBURDEN WELL CONSTRUCTION
SCHEMATIC

Site: FORT TOTTEN

Well No.: P4

Date Installed: 11-22-94

Elevations (ft)



Water Level from Top of (Casing) (Riser): ^{SURFACE} 20 Date: 11-20-94 Time: 930

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New York, N.Y. 10001

OVERBURDEN WELL CONSTRUCTION
SCHEMATIC

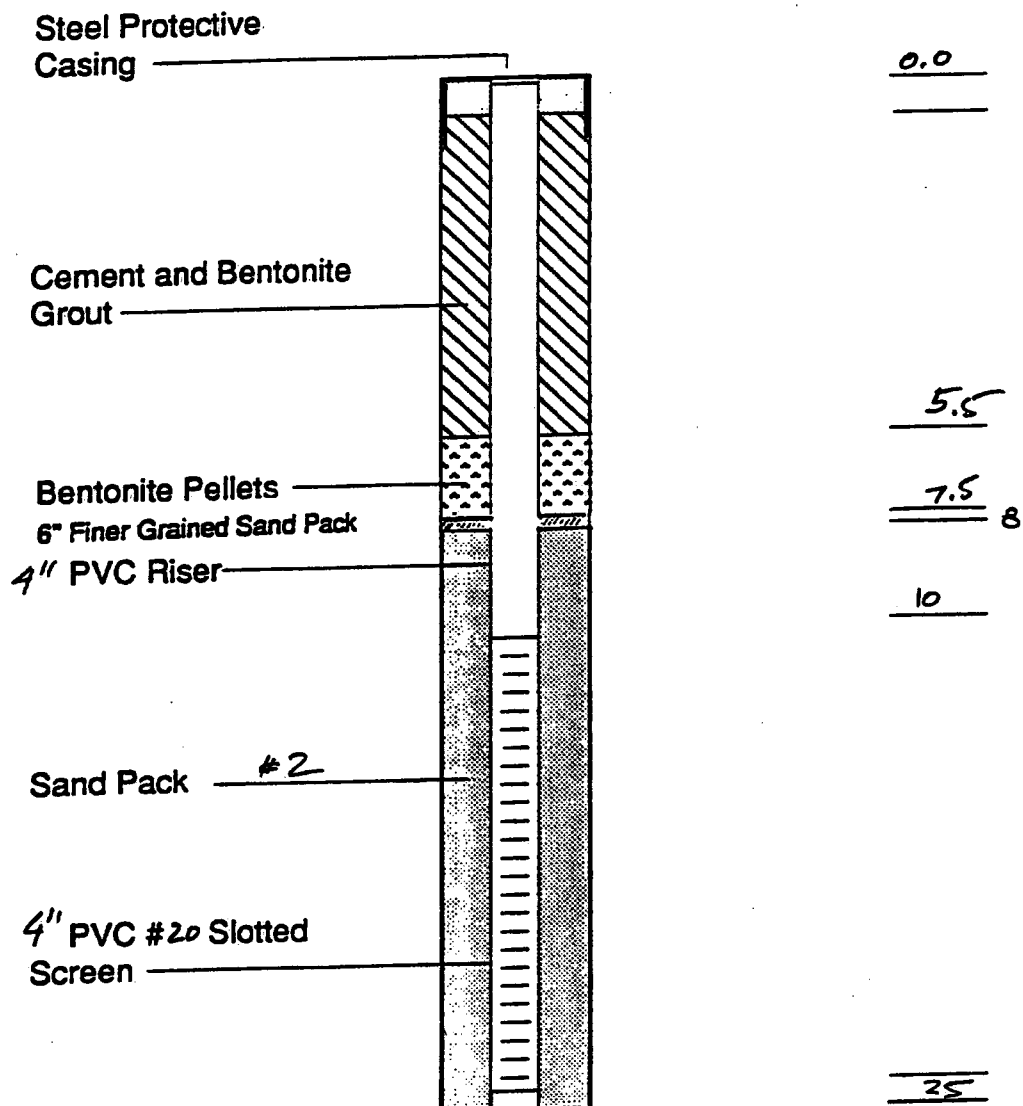
Site: **FORT TOTTER**

Well No.: **95**

Date Installed: **11-21-94**

Elevations (ft)

FLUSH MOUNTED WELL



Water Level from Top of (Casing)(Riser): **13**

Date: **11-21-94** Time: **2 PM**

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New York, N.Y. 10001

**OVERBURDEN WELL CONSTRUCTION
SCHEMATIC**

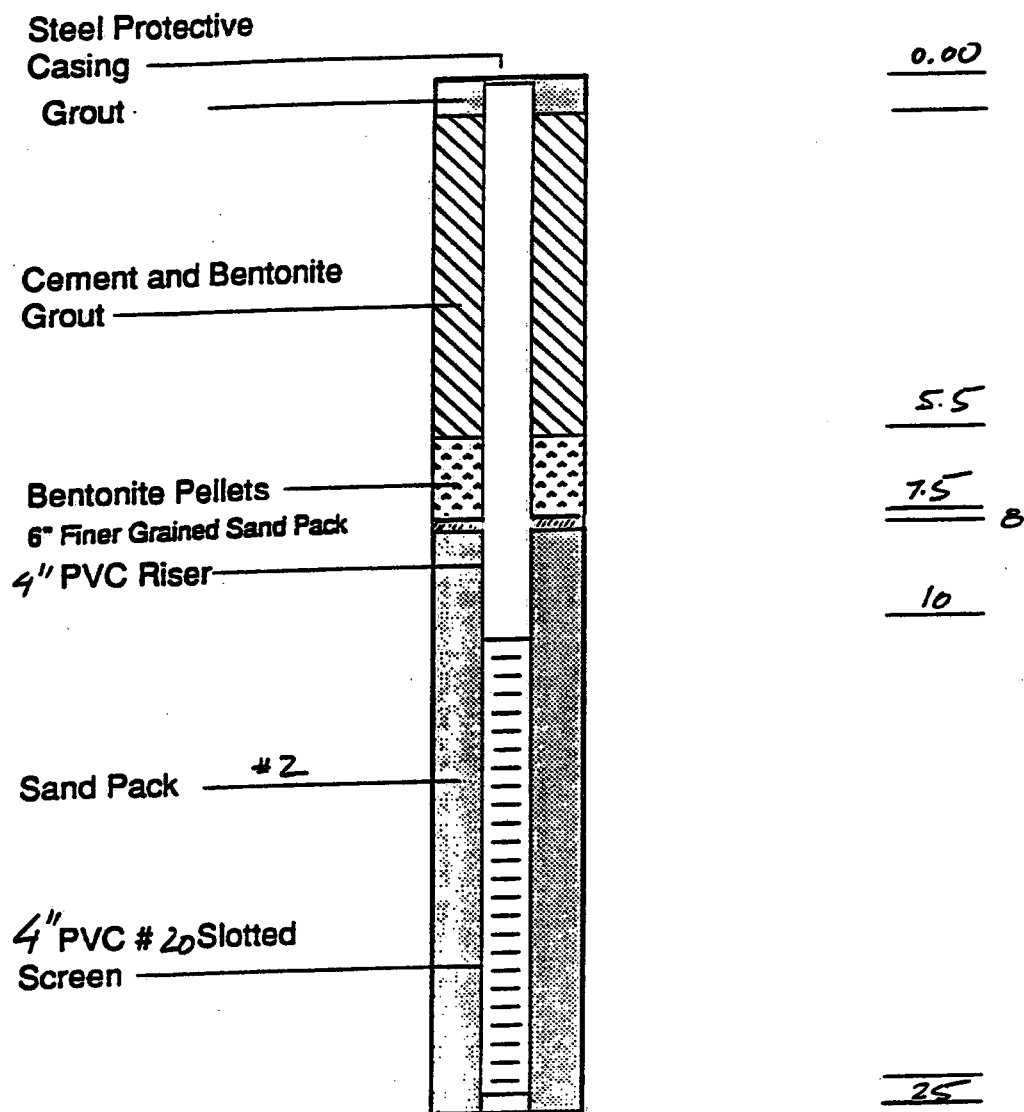
Site: FORT TOTTEN

Well No.: PG

Date Installed: 11-14-94

Elevations (ft)

FLUSH MOUNTED WELL



Water Level from Top of (Casing)(Riser): 15' # Date: 11-14-94 Time: 11 am

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New York, N.Y. 10001

OVERBURDEN WELL CONSTRUCTION
SCHEMATIC

Site: **FORT TOTTEN**

Well No.: **P7**

Date Installed: **11-14-94**

Elevations (ft)

FLUSH MOUNTED WELL

Steel Protective
Casing

0.0

Cement and Bentonite
Grout

4.5

Bentonite Pellets
6" Finer Grained Sand Pack

6.5 7

PVC Riser

9

Sand Pack

PVC # Slotted
Screen

24

Water Level from Top of (Casing)(Riser): **10**

Date: **11-14-94** Time: **3 pm**

HILL INTERNATIONAL, INC.
11 Penn Plaza
New York, N.Y. 10001

**OVERBURDEN WELL CONSTRUCTION
SCHEMATIC**

Site: *FORT TOTTEN*

Well No.: *P8*

Date Installed: *11-15-94*

Elevations (ft)

FLUSH MOUNTED WELL

Steel Protective
Casing

0.0

Cement and Bentonite
Grout

3

Bentonite Pellets
6" Finer Grained Sand Pack

5

5

4" PVC Riser

7

Sand Pack

#2

4" PVC #20 Slotted
Screen

23

Water Level from Top of (Casing)(Riser): *13*

Date: *11-15-94* Time: *3:30 pm*

HILL INTERNATIONAL, INC.
11 Penn Plaza
New York, N.Y. 10001

OVERBURDEN WELL CONSTRUCTION
SCHEMATIC

Site: FORT TOTTEN

Well No.: P9

Date Installed: 11-16-94

Elevations (ft)

FLUSH MOUNTED WELL

Steel Protective
Casing

0.6

Cement and Bentonite
Grout

3.5

Bentonite Pellets
6" Finer Grained Sand Pack

6.5
7.0

PVC Riser

9.0

Sand Pack

PVC # Slotted
Screen

24

Water Level from Top of (Casing)(Riser): 13

Date: 11-16-94 Time: 11 am

HILL INTERNATIONAL, INC.
11 Penn Plaza
New York, N.Y. 10001

OVERBURDEN WELL CONSTRUCTION
SCHEMATIC

Site: **FORT TOTTEN**

Well No.: **P 10**

Date Installed: **11-15-94**

Elevations (ft)

FLUSH MOUNTED WELL

Steel Protective
Casing

0.0

Cement and Bentonite
Grout

6.0

Bentonite Pellets
6" Finer Grained Sand Pack

8.0

8.0

PVC Riser

10.0

Sand Pack

PVC # Slotted
Screen

20

Water Level from Top of (Casing)(Riser): **12.5**

Date: **11-15-94** Time: **3:30 pm**

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New York, N.Y. 10001

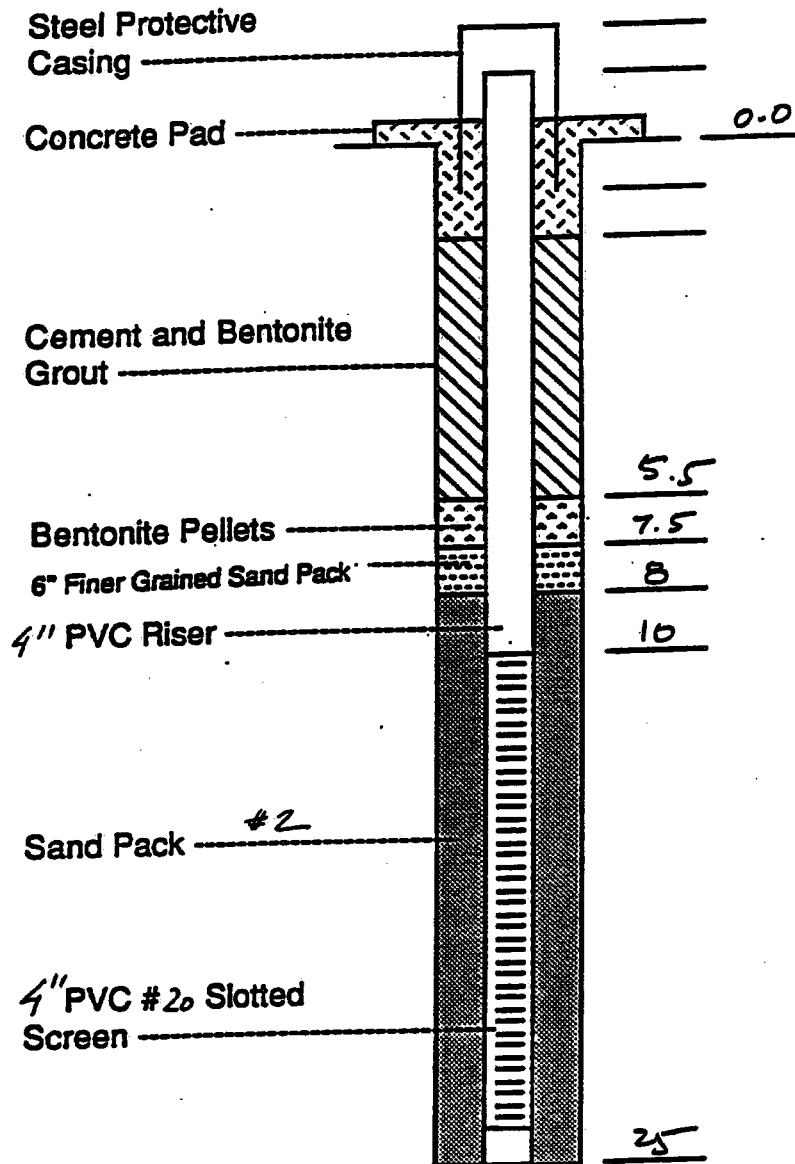
**OVERBURDEN WELL CONSTRUCTION
SCHEMATIC**

Site: FORT TOTTEN

Well No.: P 11

Date Installed: 11-17-94

Elevations (ft)



Water Level from Top of (Casing) (Riser): 14 ft Date: 11-17-94 Time: 10 am

HILL INTERNATIONAL, INC.
11 Penn Plaza
New York, N.Y. 10001

OVERBURDEN WELL CONSTRUCTION
SCHEMATIC

Site: ~~FORT TOTTEN~~

Well No.: P 12

Date Installed: 11-17-94

Elevations (ft)

FLUSH MOUNTED WELL

Steel Protective
Casing

0.0

Cement and Bentonite
Grout

5.5

Bentonite Pellets
6" Finer Grained Sand Pack
PVC Riser

7.5
8.0

10

Sand Pack

PVC # Slotted
Screen

20

Water Level from Top of (Casing)(Riser): 18

Date: 11-17-94 Time: 3 pm

HILL INTERNATIONAL, INC.
11 Penn Plaza
New York, N.Y. 10001

OVERBURDEN WELL CONSTRUCTION
SCHEMATIC

APPENDIX B

FIELD WORK REPORT
GROUNDWATER SAMPLING

WELL SAMPLING SUMMARY REPORT

Site: Fort Totten

Date: 12/13 - 12/14/94

Samplers: A. Kostic, D. Braithwaite

Monitoring well designation was used to designate groundwater sample, i.e. sample P1 indicates that the groundwater sample was collected from the monitoring well P1. Samples were collected to be analyzed for groundwater parameters presented in the table below.

Table 1 - Groundwater Parameters/Sample Number

Parameter \ Sample No	1	3	4	5	6	7	8	9	10	11	12	D
TCL Volatiles	X	X	X	X	X	X	X	X	X	X	X	X
TCL semivolatiles	X	X	X	X	X	X	X	X	X	X	X	X
TCL Pest.\PCBs	X	X	X	X	X	X	X	X	X	X	X	X
TAL Metals+Cyanide	X	X	X	X	X	X	X	X	X	X	X	X
COD	X	X	X	X	X	X	X	X	X	X	X	X
Ammonia	X	X	X	X	X	X	X	X	X	X	X	X
Chloride	X	X	X	X	X	X	X	X	X	X	X	X
Sulfate, Nitrate, TKN		X					X		X			X
TOC, TOX, TDS		X					X		X			X

Notes:

X indicates that analysis was performed

Pest Pesticides

TKN Kjeldah (total) nitrogen

COD Chemical Oxygen Demand

TOC Total Organic Carbon

TDS Total Dissolved Solids

TOX Total Organic Halogens

Groundwater samples were collected using enclosed procedures.

Dedicated disposal polyethylene bailers and synthetic ropes were used to collect groundwater samples for volatile and semivolatile organic compounds.

A peristaltic pump with dedicated silicon tubings and teflon suction and discharge hoses was used to collection samples for all other parameters.

Before sampling all wells were evacuated by a peristaltic pump. Volume of evacuated groundwater is presented in Table 2 below. Applied evacuation procedure is enclosed.

Table 2 - Well Evacuation Data

Well No.	Boring Depth, ft.	Depth to Water, ft.	Water Volume, gal.	Gallons purged
P1	20	17.9	1.37	6
P2	NA	NA	NA	NA
P3	30	15.32	9.55	30
P4	30	15.4	9.54	30
P5	25	11.65	8.71	30
P6	25	6.2	12.3	40
P7	24	8.2	10.3	32
P8	23	8.9	14.1	30
P9	24	9.88	14.12	30
P10	20	9.86	10.4	32
P11	25	7.8	17.2	50
P12	20	3.56	16.44	50

Notes:

1. Water level was measured from the surface before purging.

APPENDIX C

FIELD PROCEDURES

BOREHOLE DRILLING PROCEDURES

1.0 Discussion

Exploratory boring will be performed to accomplish one or all of the following tasks:

- 1.1 To obtain samples of subsurface materials which can be visually examined and identified.
- 1.2 To conduct downhole geophysical logging.
- 1.3 To obtain samples for physical and/or chemical analysis.
- 1.4 To determine approximate groundwater elevations.

2.0 Equipment

- 2.1 Boreholes shall be made with drilling equipment designed to drill holes of the required sizes and depths specified in Site Work Plan. The Contractor is responsible for providing all appropriate equipment and materials in accordance with Site Work Plan.
- 2.2 Exploratory boring may be accomplished by various drilling methods such as augering or cable tool drilling. Since representative samples of the material encountered at discrete depth intervals will generally be required, the use of solid stem or hollow stem auger is the preferred method.
- 2.3 In areas where an auger rig is unnecessary or cannot be employed due to access constraints, a restricted access rig, with straight split-spoon sample collection, will be utilized.

3.0 Procedures

- 3.1 Boreholes and well locations identified in the Site Work Plan are tentative and will be verified by the field representative in the field. Prior to sampling, the sampling location will be measured by the field representative relative to at least two permanent recognizable landmarks.
- 3.2 The field representative, during the initial site reconnaissance, determines the nearest source of potable water suitable for drilling activities. The Driller is responsible for obtaining all required permits, to obtain water, and to provide all required hoses, valves, and connections. Water obtained from a public potable water source need not be analyzed for contamination before use.

- 3.3 The field representative, during the initial site reconnaissance, evaluates drilling rig accessibility to each well and boring location. However, the Driller is solely responsible for assessing and providing equipment suitable for each location.
- 3.4 The field representative shall also determine the presence and locations of any subsurface utility obstructions and nearby overhead power lines prior to commencement of work. Contact Utility Hot Line: 1-800-272-4480.
- 3.5 Reasonable precaution must be taken to contain all cuttings returned to the ground surface by the auger for proper disposal. These cuttings will be placed in drums. See Storage of Cuttings and Fluides Procedures.
- 3.6 Every precaution is to be taken to minimize or avoid the introduction of extraneous material (water, additives) into the borehole.
- 3.7 Prior to any drilling, an area will be designated by field representative for equipment clean up (decontamination). The area will be prepared by the Driller in such a way that all washing fluids and soil can be collected for proper disposal.
- 3.8 The Driller shall be responsible for providing access to all testing locations and for setting up cleaning (decontamination) area. The manner of access and setting up shall be subject to the approval of the field representative.
- 3.9 Special attention shall be paid to the proper decontamination of all soil sample handling equipment (split-spoon samplers, stainless steel spatula, etc.) which must be free of grease, oil and other forms of contamination. If clean split-spoon and spatula are to be left for any length of time, they must be foil wrapped and secured. (See Cleaning Procedures)
- 3.10 To avoid cross-contamination from borehole to borehole, the drilling equipment (auger flights, etc.) shall be properly decontaminated using cleaning methods described in the section: Cleaning Procedures.
- 3.11 The Project Manager is the direct contact with the Client. The Project Manager is responsible for the coordination of site activities through communication with site personnel; to coordinate with laboratory and drillers, and to oversee the field activities. Project Manager reports all QA deviations to QA/QC group.
- 3.12 Responsibilities of Health and Safety Officer or his designee on the site (for field personnel only) is described in the Health and Safety Plan.

Note: The Driller is responsible for health and safety of their personnel.

MONITORING WELL INSTALLATION PROCEDURES OVERBURDEN WELL

1.0 Discussion

Monitoring well installations are designed to provide:

- 1.1 Accurate piezometric measurements;
- 1.2 samples of groundwater for physical and/or chemical analysis; and,
- 1.3 information on aquifer characteristics.

2.0 Equipment

Boring equipment consists of a drilling rig and appurtenant items such as augers, rods, bits, pumps, hoses, etc.

3.0 Procedures

- 3.1 Driller is responsible to obtain state well permits required for each boring and monitoring well installed. Field representative shall obtain all other permits such right-of-access, right-of-way, etc.
- 3.2 The State well permit number must be prominently displayed and permanently affixed to each monitoring well. Each well must also have a site-specific identification number permanently affixed (e.g., MW-1).
- 3.3 Copies of the site-specific well specifications and State approved well permit must be maintained at the site by the Driller.
- 3.4 Approved borehole Drilling Procedures will be followed in the drilling monitoring well boreholes. The diameter of the borehole drilled to case off the overburden well must be a minimum of four (4) inches greater than the immediate casing it surrounds.
- 3.5 Minimum screen and riser pipe inner diameter is two (2) inches.(NYS DEC, as per TOGS 4.1.1. of 1987 requires that all wells must have a nominal four (4) inch diameter).
- 3.6 Soil samples shall be taken from each soil layer encountered or, at a maximum, at five (5) foot intervals to obtain general description of the underlying soils.

- 3.7 Well must be installed plumb and straight.
- 3.8 Flush-threaded joints must be used to avoid contamination of well by glued joints.
- 3.9 Well screens must be machine slotted and of sufficient length and placement to accommodate seasonal variations in the water table. A screen slot size of 10 to 20 are preferred for all Upstate sites. Length will generally be 10 to 15 feet with the mean water table in the middle of the screen.
- 3.10 The filter (sand, gravel) pack must be compatible with soil around the screened portion of the well and with screen opening. The gravel used for the pack should be only slightly grater than screen slot, and not more than 10% of sand should be smaller than slot size. Use #1 gravel for screen slot number 10 (screen size 0.01 inches), and #2 gravel for screens slot number 20 (screen size 0.02 inches). The filter pack must extend no more than six inches below the bottom and two to five above the top of the screen. The sand pack material must be placed using the tremie method or other method approved by the the NYS DEC Division of Solid Waste and must avoid bridging. The sand pack must be checked for proper placement.
- 3.11 A finer grained sand pack material (100% passing the No.30 sieve and less than 2% passing the No. 200 sieve) six inches thick must be placed at the top of the sand pack between the sand and the bentonite seal. (Note: NJ Field Manual does not have this requirement.)
- 3.12 The well must be sealed with an impermeable material (bentonite pellets, 0.25 in) between the casing and the borehole. The depth of the bentonite seal must be at least three (2) feet. The amount of water added to the pellets and time allowed for hydration must follow the manufacturer's recommendations. If this is not possible, water shall be introduced on the pellets in a manner to insure proper hydration (e.g. a continuous stream) for at least one hour.
- 3.13 The well must be grouted by grout of cement/bentonite, bentonite alone, or other suitable, low permeable material from the bentonite seal up to 2.5 feet below surface to prevent contamination from the surface. (See Procedures for Grouting)
- 3.14 The tops of the wells must be enclosed by a protective metal casing and locked. A surface well seal is to be constructed utilizing cement/bentonite grout or concrete (cement/sand or cement/gravel mixture to avoid cracking) and by mounding concrete pad around a 5-foot protective casing (4-inch for 2-inch riser and 6-inch for 4-inch riser, preferable square) to secure the casing in the ground. The protective casing shall be set into the well so that it sits 2.5 feet below and above the ground surface. The diameter of this well seal must be a minimum of two (2) feet. A distinctive, readily visible marker must be permanently affixed to the protective casing or nearby the well to identify the well number and ensure visibility even in periods of high snow cover. A weep hole must be drilled at the base of protective casing for drainage.

Note: Flush-mount monitoring wells are acceptable provided they have manholes, locking caps, and seals to prevent leakage of surface water into the well.

- 3.15 A concrete pad shall be constructed to provide positive drainage of surface water away from the monitor well assembly.
- 3.16 Elevations (vertical control) of each monitoring well must be provided. Survey the top of the innermost casing (excluding cap) to the nearest 0.01 foot. The survey point shall be the highest point of the casing. An incised arrow on the inside of the casing will be used to mark the surveyed point on the inside PVC pipe (riser) rim. The survey point must be marked on each well. Elevations for the ground surface at the well shall be established to the nearest 0.1 foot. USGS bench marks will be referenced whenever available.
- 3.17 A licenced surveyor shall establish location of each monitoring well (horizontal control). All wells shall be tied into at least two permanent objects in the area. The relative distance between each well shall be also obtained. Measurements shall be obtained accurate to within two(2) feet. Use USGS bench marks whenever available.
- 3.18 If a well cannot be completed the same day that it is drilled, a mechanism to safeguard its integrity must be devised. The Driller must provide their plan for this contingency prior to start drilling at the site.
- 3.19 Develop the well as soon as possible. The well must be sufficiently developed to ensure that samples will accurately represent the condition of the groundwater. See Well Development Procedures.

References:

- 1. 6 NYCRR Part 360, Solid Waste Management Facilities
- 2. NJDEPE Field Sampling Procedures Manual, 1992

APPENDIX D
ANALYTICAL DATA RESULTS

Table 4 - Water Standards for Inorganics
(All data in ug/l)

Analyte	MDL	A	B	C
Aluminum	200	NA	NA	NA
Antimony	100	NA	NA	NA
Arsenic	10	50	NA	25
Barium	30	1000	NA	1000
Beryllium	5	NA	NA	NA
Cadmium	10	10	NA	10
Calcium	800	NA	NA	NA
Chromium	30	50	NA	50
Cobalt	30	NA	NA	NA
Copper	30	NA	1000	1000
Iron	100	NA	300	500
Lead	10	50	NA	25
Magnesium	10	NA	NA	35000
Manganese	15	NA	50	300
Mercury	0.5	2	NA	2
Nickel	40	NA	NA	NA
Potassium	10000	NA	NA	NA
Selenium	5	10	NA	10
Silver	10	50	NA	50
Sodium	1000	NA	NA	NA
Thallium	10	NA	NA	NA
Vanadium	50	NA	NA	NA
Zinc	100	NA	5000	300
Cyanide	10	NA	NA	NA

Table 4 - Water Standards for Inorganics (Cont'd)

Notes:

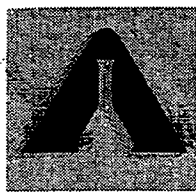
MDL **Method Detection Limits**

A **40 CFR Part 141, National Primary Drinking Water Regulations, Maximum Contaminant Level (MCL)**

B **10 NYCRR, Subpart 5.1, Secondary Maximum Contaminant Level (SMCL)**

C **NYS DEC Water Cleanup Criteria, Ambient Water Quality Standards and Guidance Values**

NA **Standard not available**



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-1-

Analytical Data Report

for

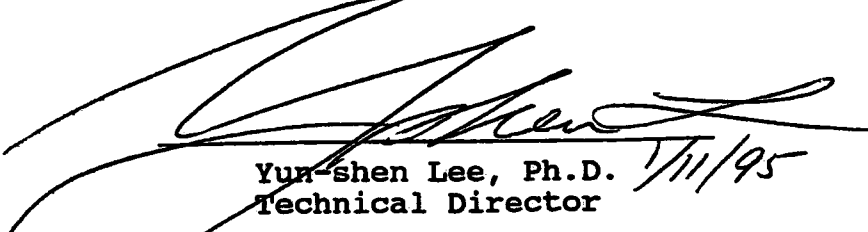
Hill International
11 Penn Plaza
New York, NY 10001

Project: Fort Totten Landfill

Accredited Laboratories Case No.: 9774
Date Received: 12/14/94

<u>Field ID</u>	<u>Laboratory Sample #</u>
P8	9418535
P10	9418536
P3	9418537
P13	9418538
P1	9418539
P4	9418540
P5	9418541
P6	9418542
P7	9418543
P9	9418544
P11	9418545
P12	9418546
TB	9418557

Accredited Laboratories, Inc. New York Certification Number
11109. This data has been reviewed and accepted by:


Yun-shen Lee, Ph.D. 1/11/95
Technical Director

NEW YORK STATE DEPARTMENT OF HEALTH

MARK R. CHASSIN, M.D., M.P.P., M.P.H. COMMISSIONER



Expires 12:01 AM April 1, 1993
ISSUED April 1, 1993
REVISED June 7, 1993

INTERIM CERTIFICATE OF APPROVAL FOR LABORATORY SERVICE

Issued in accordance with and pursuant to section 502 Public Health Law of New York State

Lab ID No.: 11109

Director: DR. YUN-SHEN LEE

Lab Name: ACCREDITED LABORATORIES INC

Address : FOOT OF PERSHING AVE PO 369
CARTERET NJ 07008-0369

is hereby APPROVED as an Environmental Laboratory for the category

ENVIRONMENTAL ANALYSES NON POTABLE WATER

All approved subcategories and/or analytes are listed below:

Chlor. Hydrocarbon Pesticides :

4,4'-DDD
4,4'-DDE
4,4'-DDT
alpha-BHC
Aldrin
beta-BHC
Captan
Chlordane Total
delta-BHC
Dieldrin
Endrin aldehyde
Endrin
Endosulfan I
Endosulfan II
Endosulfan sulfate
Heptachlor
Heptachlor epoxide
Lindane
Methoxychlor
Toxaphene

Wastewater Miscellaneous :

Boron, Total
Cyanide, Total
Color
Phenols
Oil & Grease Total Recoverable
Hydrogen Ion (pH)
Specific Conductance
Sulfide (as S)
Temperature
Organic Carbon, Total
TCLP Additional Compounds (ALL)

Chlorophenoxy Acid Pesticides :

2,4-D
2,4,5-TP (Silvex)
Demand (ALL)
Wastewater Metals III (ALL)
Wastewater Metals II (ALL)
Nitroaromatics and Isophorone (ALL)
Nutrient (ALL)
Polychlorinated Biphenyls (ALL)
Priority Pollutant Phenols (ALL)
Purgeable Halocarbons (ALL)

Acrolein and Acrylonitrile (ALL)

Benzidines (ALL)
Chlorinated Hydrocarbons (ALL)
Haloethers (ALL)
Wastewater Metals I (ALL)
Mineral (ALL)
Nitrosoamines (ALL)
Polynuclear Aromatics (ALL)
Phthalate Esters (ALL)
Purgeable Aromatics (ALL)
Residue (ALL)

Serial No.: 021068

Wadsworth Center for Laboratories and Research

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Must be conspicuously posted. Valid certificate has a red serial number.

Foot of Pershing Avenue, P.O. Box 369
Lanerel, New Jersey 07008-0369



Client: Hill Environmental, Inc
Address: 11 Penn Plaza
City: New York NY

Project: Fort Totten Landfill
Contact: Mr. Alex Kostic
Phone: 212-216-6644
Fax: 212-216-6002

P.O. Number _____ State, Zip: 10001

** M = Matrix (A)=Aqueous (S)=Soil (G)=Sludge (P)=Potable Water (O)=Oil
(F)=Filter (K)=Solid (X)=Other _____

* C = No. Containers

Deliverables (circle one): STD Reduced Regulatory ECRA CLP I CLP II

Turnaround: 2 weeks Fax
(if blank, std applies)

3 week A.C.

ALI Sample No.	Field ID	C*	M**	Date/Time SAMPLED	Sample Description	Analyses
P8	9418535		A	12/14		VOCs, Semi-VOCs, Pest/PCBs
P10	9418536		A	12/14		Met, Cu, SO ₄ , NO ₃
P3	118537		A	12/13		COB/NH ₃ , TOC, TOX
P13	118538		A	12/14	Duplicate	TDS, TKN, Cl ⁻
+ TB	118551		A	12/14/94	Trip Blank	VO+10(TCL)

Person(s) Assuming Responsibility for Sampling: Print Alex Kostic Sign Alex Kostic

Relinquished By: print	Relinquished By: sign	Received By: print	Received By: sign	Organization	Date	Time	Reason
Alex Kostic	Alex Kostic	D. Murdock	D. Murdock	J.T.L.	12/14/94	3:10 pm	Pick Up
D. Murdock	D. Murdock	D. Murdock	D. Murdock	ALI	12/14/94	5:10 pm	Analytical

Comments: Note: VOC+10 (TCL), BNA + 20 (TCL), Pest/PCB TCL and TAL metals + cyanide
8240 8270
*Analyze TB 12/15/94 wu
ALI CASE NO. C-9774



Client: Hill Environmental, Inc Project: Fort Totten Landfill
 Address: 11 Penn Plaza Contact: Alex Kostic
 City: New York, NY Phone: 212-216-6644
 P.O. Number _____ State, Zip: 10004 Fax: 212-216-6002

** M = Matrix (A)=Aqueous (S)=Soil (G)=Sludge (P)=Potable Water (O)=Oil
 (F)=Filter (K)=Solid (X)=Other _____

* C = No. Containers

Deliverables (circle one): STD Reduced Regulatory ECRA CLP I CLP II

Turnaround: 2 weeks Fax
 (if blank, std applies)

3 weeks H.C.

ALI Sample No.	Field ID	C*	M**	Date/Time SAMPLED	Sample Description	Analyses
P1	04180000		A	12/13		VOCs, Semi-Voc, Pest/PCB
P4	04180000		A	12/13		Met., Cu, Cd/Pb, Co
* P5	04180001		A	12/14		
P6	04180002		A	12/14		
P7	04180003		A	12/13		
P9	04180004		A	12/14		
P11	04180005		A	12/14		
P12	04180006		A	12/14		

Person(s) Assuming Responsibility for Sampling: Print ALEX KOSTIC Sign Alex Kostic

Relinquished By: print	Relinquished By: sign	Received By: print	Received By: sign	Organization	Date	Time	Reason
ALEX KOSTIC	Alex Kostic	D. Murdock	D. Murdock	F.T.L.	12/14/94	3 ¹⁰ PM	Pick Up
D. Murdock	D. Murdock	B. O'Mara	B. O'Mara	ALI	12/14/94	5 ¹⁰ PM	Analytical

Comments: Note: 10C+10 (TCL), BNA+20 TCL, Pest/PCB's TCL and TCL metals + Cyanide
 8240 8270
 *For BNA+20 and Pest/PCB - use only 500ml for each + report normal detection limits...
 ALI CASE NO. 2974

METHODOLOGY SUMMARY

Volatile Organics - EPA 8240 (aqueous)

Volatile organic compounds are purged from a 5 ml sample by bubbling an inert gas through the aqueous sample. The purgeables are trapped in a sorbent column. When purging is completed, the sorbent column is heated and back-flushed with the inert gas to desorb the purgeables onto a GC column. The GC is temperature-programmed to separate the purgeables which are then detected with a mass spectrometer.

Base-Neutral/Acid Extractables - EPA 625 (aqueous)

A 1 liter aqueous sample is serially extracted with methylene chloride at a pH greater than 11 and again at a pH less than 2. The methylene chloride extract is dried and concentrated. The extracts are combined and spiked with the internal standards prior to the injection. A measured amount is injected onto a GC and the analytes are detected with a mass spectrometer.

Pesticides/PCB's - EPA 608 (aqueous)

A measured volume of sample, approximately 1-L, is extracted with methylene chloride using a separatory funnel. The methylene chloride extract is dried and exchanged to hexane during concentration to a volume of 10 ml or less. The extract is separated by gas chromatography and the parameters are then measured with an electron capture detector.

Total Cyanide - EPA 335.2 (aqueous)

An appropriate volume of sample is placed into a cyanide distillation apparatus. Cyanide gas is liberated from the aqueous solution upon addition of sulfuric acid, magnesium chloride and heat. The gas is trapped in a scrubber containing sodium hydroxide solution. The concentration of cyanide in the caustic solution is determined colorimetrically according to EPA "Method for Chemical Analysis of Water and Wastewater" 1983.

Chloride - EPA 325.3 (aqueous)

An acidified sample is titrated with mercuric nitrate in the presence of mixed diphenylcarbazone-bromophenol blue indicator. The end point of the titration is the formation of the blue-violet mercury diphenylcarbazone complex.

Chemical Oxygen Demand - EPA 410.4 (colorimetric)

A well-mixed sample in a sealed tube is heated in an oven in the presence of dichromate at 150°C. After two hours, the tube is removed and cooled. The measurement of COD is determined spectrophotometrically.

Metals (aqueous)

A 100 ml portion of aqueous is digested with nitric acid on a hot plate and evaporated to near dryness cautiously. The digestate is then refluxed with either nitric acid or hydrochloric acid. Diluted hydrochloric acid is used as the final reflux acid for the flame AA or ICAP of Ag, Al, Ba, Be, Cd, Cr, Co, Cu, Fe, Pb, Ni, Sb, Sn, Tl and Zn. Diluted nitric acid is employed as the final dilution acid for the furnace AA analysis of As, Pb and Se. For the graphite furnace analysis, an aliquot of the digestate is spiked with modifier solution and is placed into the graphite furnace. The aliquot is then slowly evaporated to dryness, charred and atomized. The absorption of the EDL radiation during atomization is proportional to the element concentration. For the flame AA, the digestate is aspirated and atomized into a flame. The absorption of the HCL radiation during atomization is proportional to the element concentration. The basis of the ICAP method is the measurement of the atomic emission by an optical spectroscope technique. The emission spectra are dispersed by a grating spectrometer and the intensities of the line are measured and processed by a computer system. For mercury analysis, a 100 ml portion of sample is digested with potassium permanganate and persulfate at acidic conditions in a water bath at 95°C. The mercury in the sample is reduced to the elemental state and detected by the cold vapor technique in a closed system. The analytical procedures associated with the Atomic Absorption technique are derived from "EPA Methods for Chemical Analysis of Water and Wastes" - EPA Method 200 Series. The analytical procedures associated with ICAP techniques are derived from EPA Method 200.7.

Ammonia, Nitrogen - EPA 350.3 (aqueous)

The ammonia is determined potentiometrically using an ion selective ammonia electrode and a specific ion meter.

Nitrate, Nitrogen - EPA 352.1 (aqueous)

The nitrate ion in the sample is reacted with brucine sulfate in a 13 N H₂SO₄ solution at 100°C to form a color complex. The color complex is then measured at 410 nm which is proportional to the concentration of nitrate in the sample.

Sulfate - EPA 375.3 (aqueous)

Sulfate is precipitated as barium sulfate in a hydrochloric acid medium by the addition of barium chloride. After a period of digestion, the precipitate is filtered, washed with hot water until free of chloride, ignited and weighed as BaSO₄.

Residue, Filterable or Total Dissolved Solids - EPA 160.1 (aqueous)

A 100 ml portion of aqueous sample is filtered through the glass fiber filter under vacuum. The filtrate is transferred to a pre-weighed evaporating dish and is evaporated to dryness on a steam bath. The evaporating dish is dried in an oven at 180± 2°C for at least 2 hours. The dish is then cooled in a desiccator and weighed to a constant weight. The analytical procedure is conducted in accordance with EPA Method 160.1.

Total Kjeldahl Nitrogen - EPA 351.3 (aqueous)

A measured sample is digested by concentrated H₂SO₄ in a block digester. The organic nitrogen compounds are converted to (NH₄)₂SO₄. The ammonia in the digested sample is then distilled and determined potentiometrically with an ion selective electrode.

Total Organic Carbon - EPA Method 415.1 (aqueous)

Organic Carbon is converted to CO₂ by catalytic combustion or wet chemical oxidation. The CO₂ can be measured directly by an infrared detector. The amount of CO₂ or CH₄ is directly proportional to the concentration of carbonaceous material in the sample.

Total Organic Halides - EPA Method 9020 (aqueous)

An Acidified sample is absorbed into GAC (Granular Activated Carbon) by forcing sample through a pair of packed GAC columns with nitrogen pressure. Then the GAC columns are rinsed with KNO₃ to remove the inorganic halides. The GAC is then placed in a quartz sample boat and burned in the furnace of Dohram DX-20 TOX Analyzer. The residue is then colorimetrically titrated to determine Total Organic Halides (TOX). GAC blanks are run with nanopure H₂O to determine the blank correction. Total Organic Halide is reported in (ug/l as Cl⁻). If 100 ml of sample is used, the detection limit is reported as 5 ug/l as Cl⁻.